

# ***Headquarters U.S. Air Force***

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*Integrity - Service - Excellence*

## **Air Force Vision for Systems Engineering**

**Systems and Software Technology Conference  
Salt Lake City, UT  
3 May 2006**



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# Overview

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- **Historical Perspective**
- **Visions**
  - ***Life Cycle Systems Engineering***
  - ***Life Cycle Software Policy***
- **Challenges**



# *Historical Perspective*



U.S. AIR FORCE



***“Systems  
Engineering  
is broken;  
go fix it.”***

*Attributed to Dr. James G. Roche,  
Secretary of the Air Force, Spring 2002*

**Lack of Systems Engineering has been cited as the cause  
of major defense acquisition program failures**

*... as evidenced by ...*

**cost overruns, schedule slips, mishaps, external criticism,  
instability in requirements and funding, poor acquisition strategies ...**

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# ***Historical Perspective Air Force & DoD, 2003-2005***

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- Apr 03: **SAF/AQ** policy memo on incentivizing contractors for better SE
  - Jan 04: **SAF/AQ** policy memo on revitalizing SE
  - Feb 04: **OUSD (AT&L)** policy memo emphasizing the importance of SE
  - Feb 04: **Air Force Center for Systems Engineering (CSE)** established at AFIT
  - Mar 04: **AT&L** policy memo requiring acquisition programs to develop and submit a Systems Engineering Plan (SEP) at MS and KDP Reviews
  - Sep 04: **SAF/AQ/US** policy memo on revitalizing software aspects of SE
  - Sep 04: **SAF/AQ** and **AFMC** host AF Conference on Advancing SE
  - Oct 04: **AT&L** policy memo establishing requirement for Chief Engineer position reporting to PEO
  - Oct 05: **SAF/AQ** policy memo establishing SEP review and coordination process, and identifying responsibilities for PEO Chief Engineers to ensure robust SE processes are in place
  - Dec 05: **AFI 63-1201, Life Cycle SE**, released to formal coordination
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# *Challenges*

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- **How to implement / facilitate the Life Cycle SE and software visions**
  - **Balancing depth and breadth of policy coverage across diverse communities (warfighter, HSI, CIO, ESOH, safety, *et al*)**
  - **Collaboration with industry and academia**
  - **Consistent SE application across domains (air, space, weapons, C2, IT)**
  - **SE for Systems of Systems (responsibilities, etc.)**
  - **Measures / metrics**
  - **Better preparing SE practitioners (SEP writing, etc.)**
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## **Air Force SE Vision -- Life Cycle Systems Engineering**

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# *Overview*

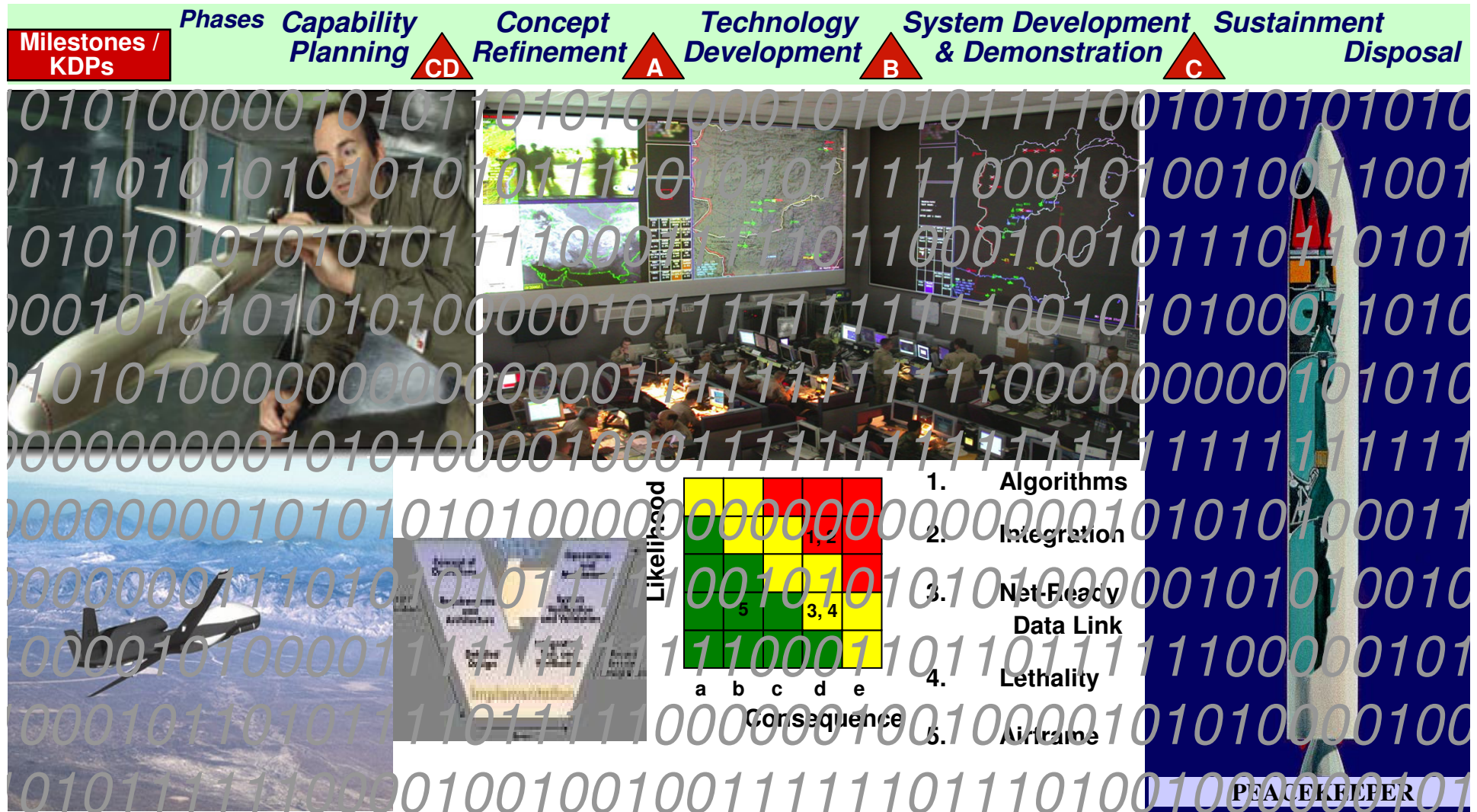
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- **SE Throughout the Life Cycle**
  - **SE Prior to Milestone/Key Decision Point A**
  - **Early SE Pilots**
  - **Summary**
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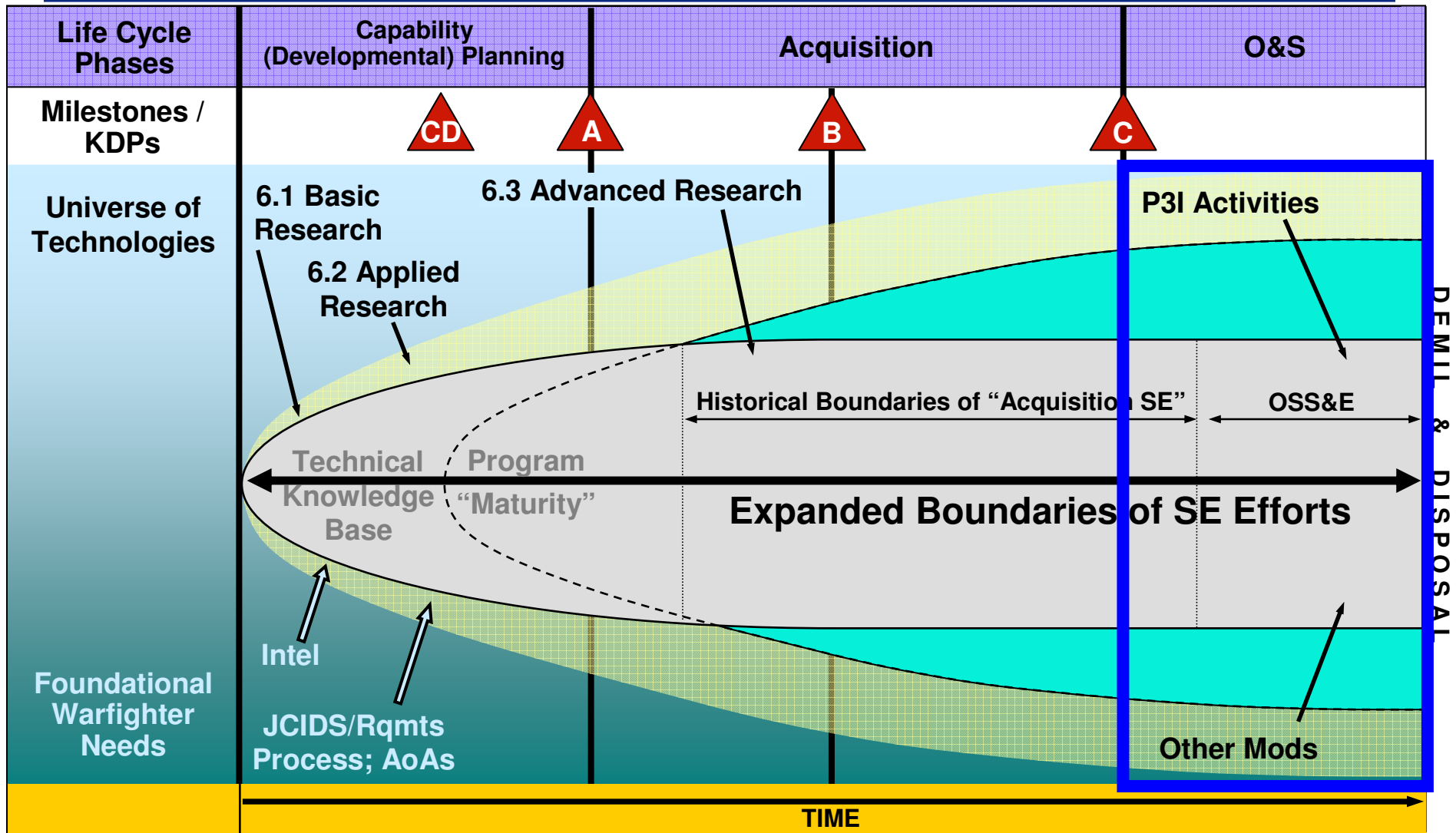


# SE Throughout the Life Cycle



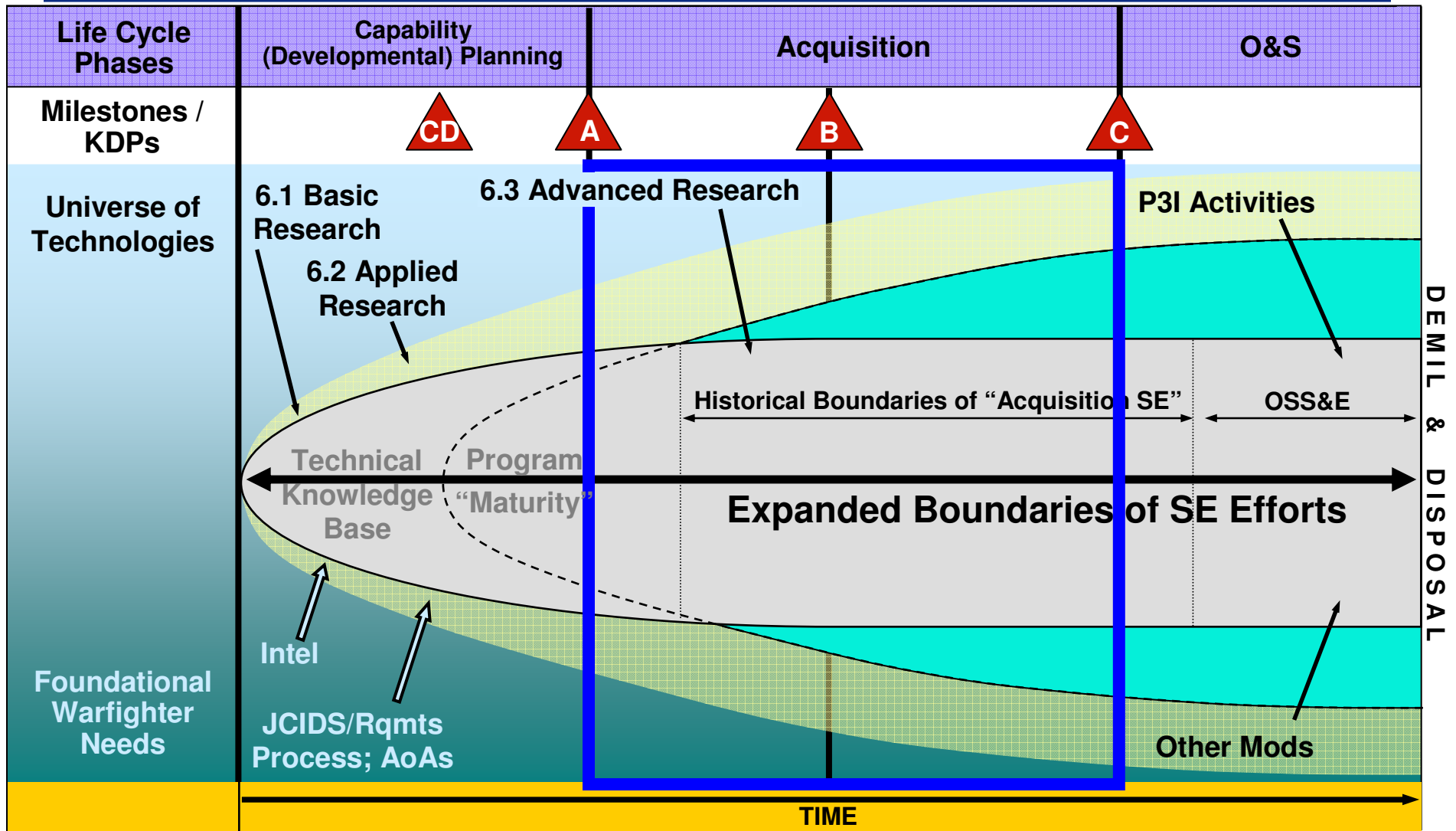


# SE Planning in Sustainment OSS&E Plan





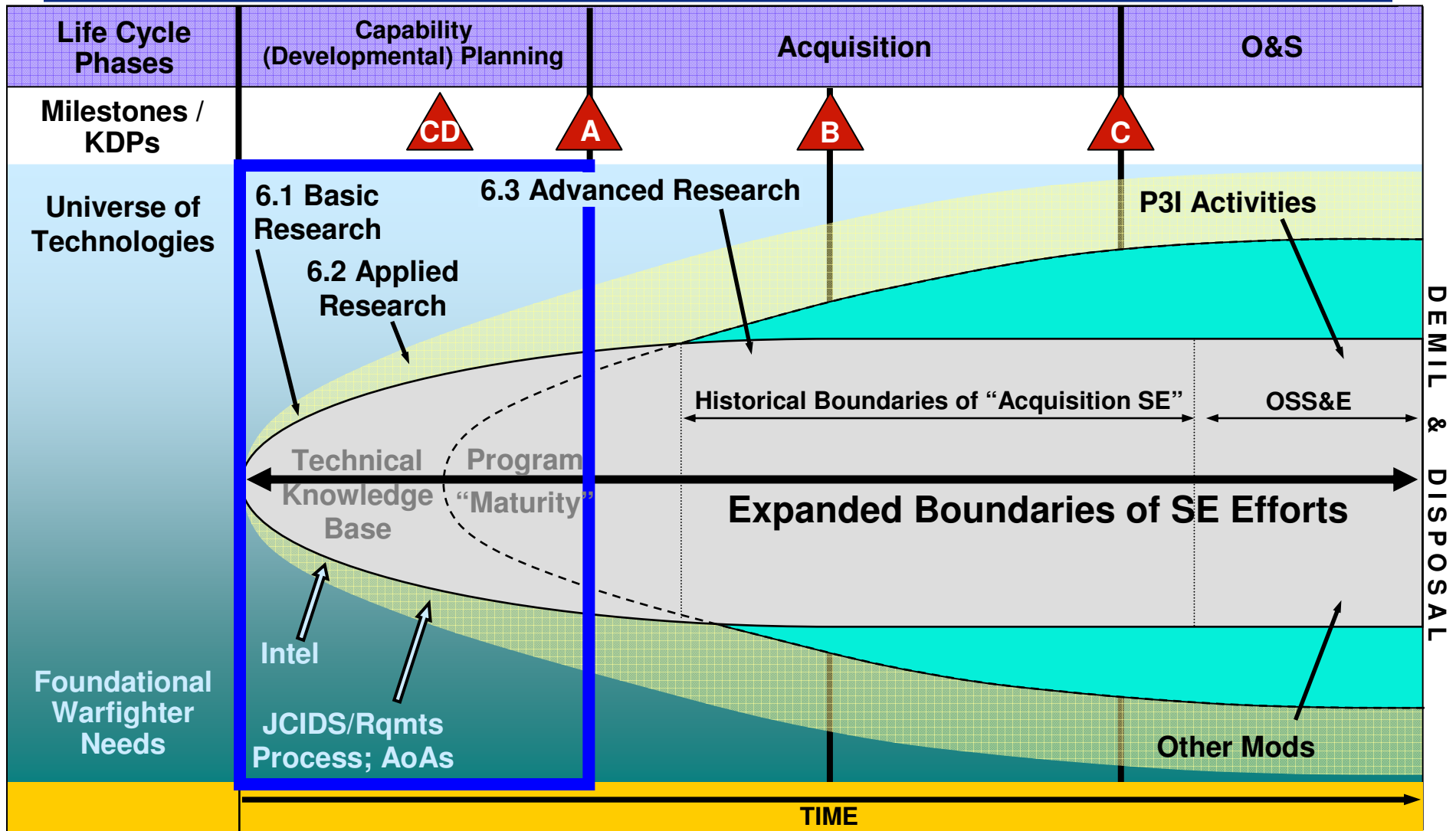
# SE Planning in Acquisition SEP





# SE Planning in Pre-Acquisition

-- to be added --





# ***Broad Interest in Pre-Acquisition Systems Engineering***

## **Congress**

- GAO reports (GAO-06-110, Nov 2005 “Better Support of Weapon System Program Managers Needed to Improve Outcomes”; several others)

## **OSD**

- Policy coming -- AT&L calls it the “grey box”
- DDR&E sees it as the big “E” in DDR&E
- QDR language directs more linkage of concepts to Joint needs

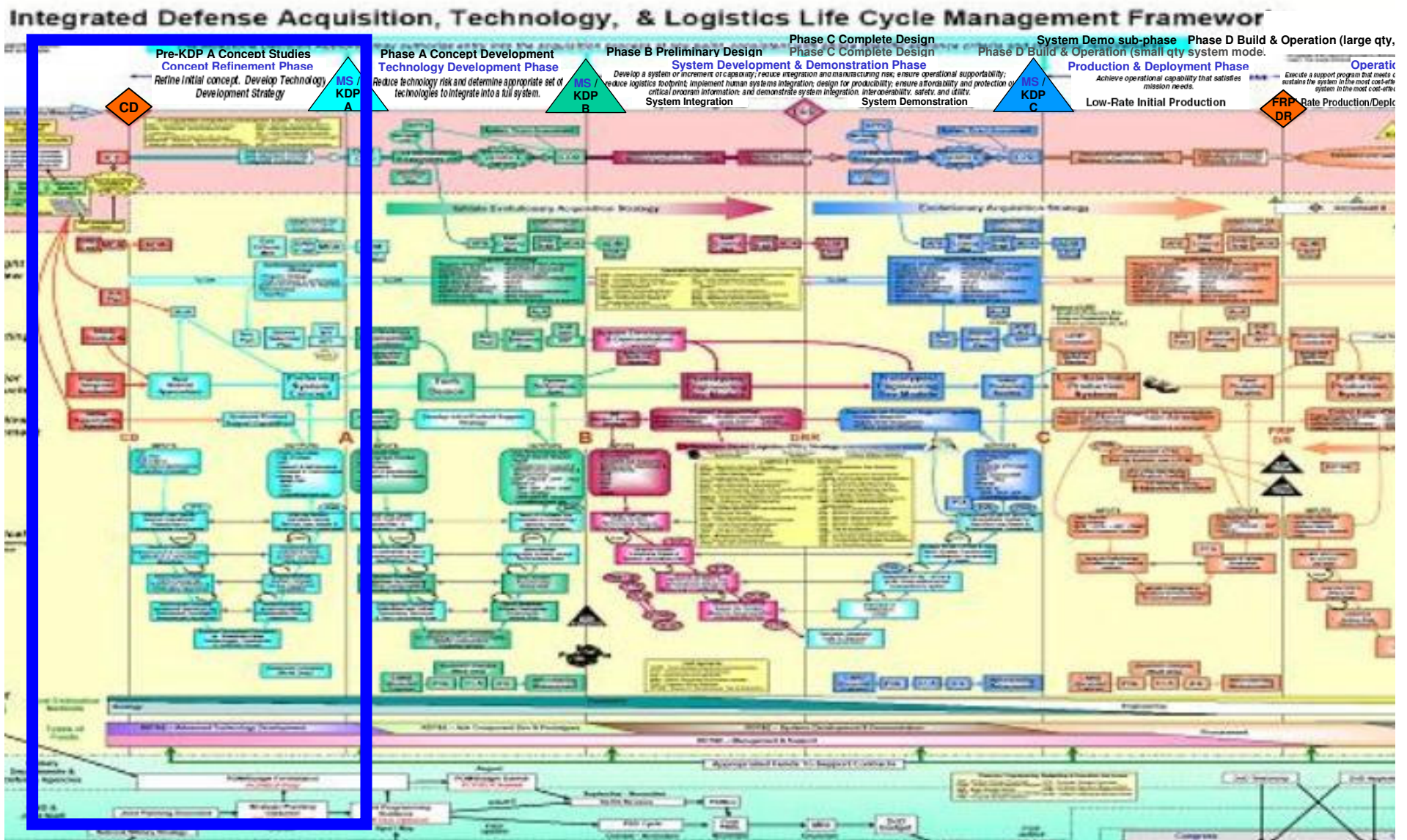
## **USAF**

- Ad hoc and non-uniform application across MAJCOMs and Centers
- Quality of SEPs at MS/KDP A and B lacking rigor (and sometimes content)
- AFSO21 creates opportunities for enterprise re-engineering



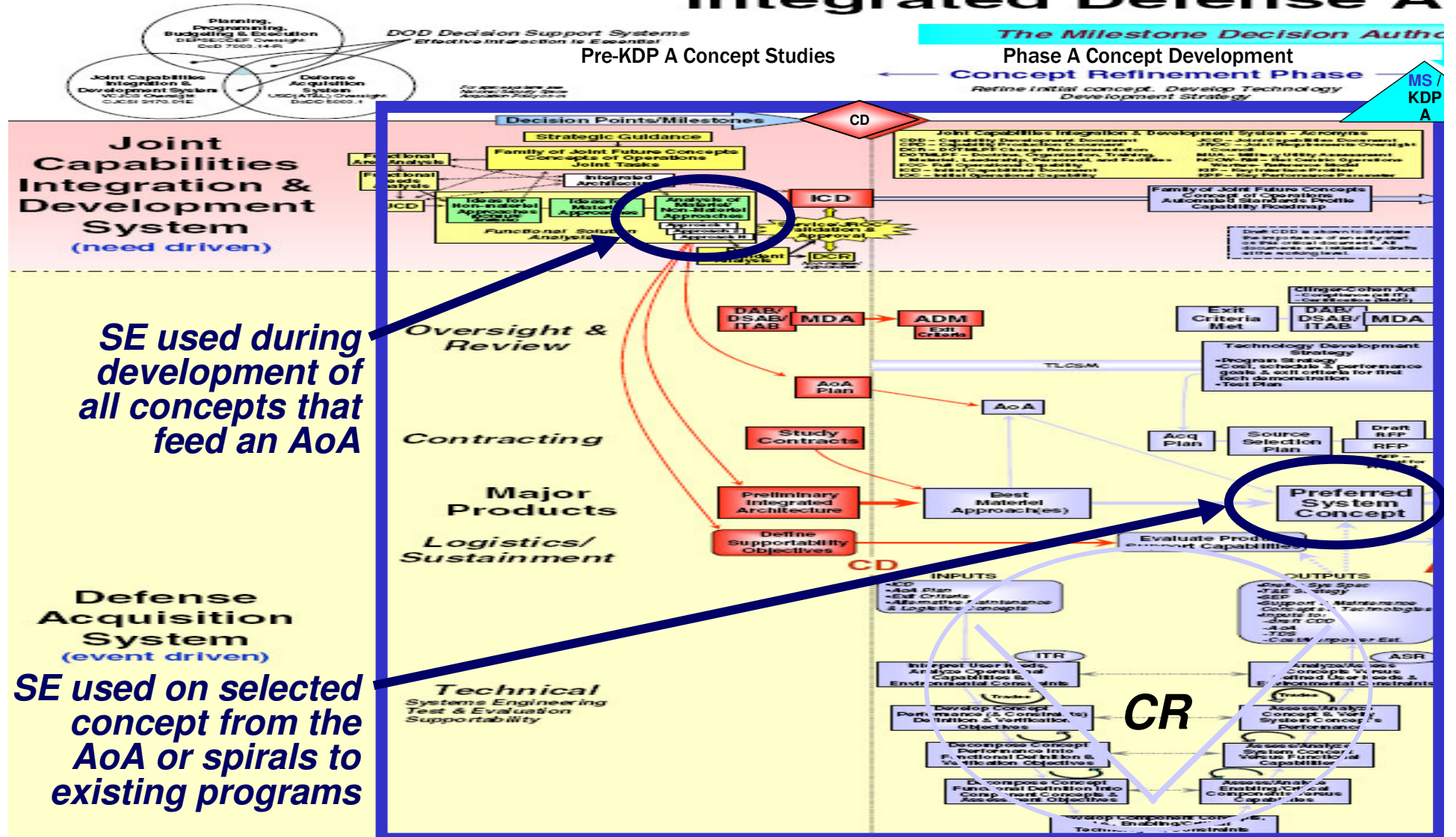


# SE Throughout the Life Cycle Pre-Acquisition Focus





## Integrated Defense A







# ***Early SE Documentation***

## **Two new SEP-like documents required from Centers**

### **Pre-CD “C-SEP” (Concept SEP)**

- Essentially a CONOPS between AFRL/XR and Product Center XR
- Lays out trade study process, decision criteria, methodology for populating knowledge base
  - Mission Needs Analysis and Mission Solution Analysis from AFSPC Integrated Planning Process generated 71 concepts for Operationally Responsive Space (ORS)
- Describes how SE processes translate “requirements” into concept designs / approaches that feed a specific AoA
- Describes how operational architectures drive these translations

### **Milestone / KDP A “A-SEP” (Alternative SEP)**

- Developed by SPO Cadre (probably Product Center XR) for selected alternative
  - e.g., Affordable Responsive Spacelift [ARES] Hybrid Launch Vehicle for ORS
- TDS will probably constitute 75% of the “meat” in this document
- Identifies how knowledge base will be further populated as the concept matures
- Approvals: Center Chief Engineer, PEO, SAF/AQ/US
  - Also OSD for ACAT ID



## ***Early SE Pilots***

### **Utilize pilots to scope policy**

- **AFSPC nominated Advanced Infra-Red Satellite System (AIRSS) (Pre-MS/KDP B spiral to SBIRS program)**
- **AFMC nominated Very Small Missile (AAC)**

### **Incorporate new Pre-A SE policy into existing SE policy**

- **Collect Lessons Learned; identify resources required to implement**
- **Incorporate into AFI 63-1201 “Life Cycle Systems Engineering” Increment 2 -- release in 2007**



# ***Expectations***

- **Disciplined Pre-A SE policy will:**
  - Flow Joint needs through concepts into programs
  - Link operational architectures to concepts to programs
  - Build technical knowledge base that migrates with concepts to program
  - Facilitate better decision-making at MS/KDP A and B
  - Integrate the “illities” up front into concept definition
- **Disciplined Pre-A SE policy will not:**
  - Provide guidance idea generation
  - Direct conduct of AoAs or EoA studies
  - Guide overall capabilities integration activities



## ***Summary***

- Disciplined SE is needed throughout the life cycle
- Pre-acquisition SE is an investment that will buy down risk in later phases of the program
- SMC and AAC have identified pilot efforts to scope pre-acquisition SE policy
- Lessons learned will be rolled into final policy and released under Increment 2 of SE AFI (63-1201)

## **ULTIMATE RESULTS**

- Better technical planning, better integrated
- More confidence in programs entering acquisition

***"We demand rigidly defined areas  
of doubt and uncertainty!"***

# ***Headquarters U.S. Air Force***

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## **Air Force Software Policy Vision**

**Systems and Software Technology Conference  
Salt Lake City, UT  
3 May 2006**



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## *Outline*

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- **Background – FY 2003 National Defense Authorization Act Section 804**
- **Development of AF software (S/W) acquisition policies**
- **Development of S/W policies across the AF**





# ***FY03 National Defense Authorization Act***

## ***Section 804***

### ***Air Force Implementation***

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- **OSD & Services establish documented processes for:**
  - **S/W Acquisition Planning**
  - **Requirements Development and Management**
  - **Project Management and Oversight**
  - **Risk Management**
- **Metrics for performance measurement and continual process improvement**
- **Ensure that key program personnel have an appropriate level of experience or training**
- **Ensure adherence to established processes and requirements relating to the acquisition of S/W**

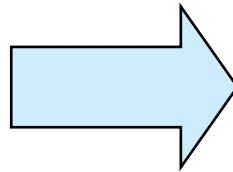
**Improve Air Force S/W management and processes as an integral part of SE and Capability Acquisition**

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# ***Air Force Acquisition Policy – Integrating S/W into SE processes***

SAF/AQ/US Policy  
Memo 04A-003,  
20 Sep 2004:  
***Revitalizing  
the Software  
Aspects of  
Systems  
Engineering***



## **Policy Memo Focus Areas**

- **High Confidence Estimates**
- **Realistic Program Baselines**
- **Risk Management**
- **Capable Developer**
- **Developer Processes**
- **Program Office Processes**
- **Earned Value Management**
- **Metrics**
- **Life Cycle Support**
- **Lessons Learned**

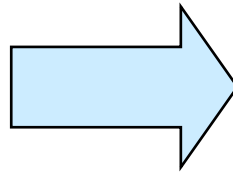
**Program Executive  
Officers (PEOs)  
Apply and Tailor  
As Necessary**



# ***Integrating s/w into SE processes – Implemented in AF acquisition guidance***

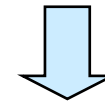
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## **Focus Areas**

- High Confidence Estimates
- Realistic Program Baselines
- Risk Management
- Capable Developer
- Developer Processes
- Program Office Processes
- Earned Value Management
- Metrics
- Life Cycle Support
- Lessons Learned



**Jul 05 – implemented in AFI 63-101 (Capabilities  
Based Acquisition System)**

**Being incorporated in AFI 63-1201 re-write (*Life-  
cycle SE*)**



# ***Need to Address S/W Policy and Guidance Across Air Force***

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## **■ Current state**

- No overarching S/W policy and guidance
- Current S/W policies defined by functional elements
  - Difficult to know & comply with all policies
  - Conflicting, redundant policies

## **■ Where we need to be**

- Identify S/W issues across AF needing AF guidance
- Define purpose and scope for AF S/W policies
- HAF S/W stakeholders collaborate to
  - Jointly address AF-wide S/W issues
  - Develop, promulgate appropriate AF S/W policies



# ***Overarching S/W Policy – Must support all activities across AF***

## **SAF/AQ & SAF/US (Acquisition)**

- Policy & Guidance for Acquisition Programs
- Program Execution & Oversight for formal acquisition programs
  - Space, non-space, AIS
- Policies
  - DoD 5000
    - NSS AP 03-01
  - AF 63-XXX

## **SAF/XC (Warfighting Integration/CIO)**

- Implements CCA
- Interoperability & interconnectivity
  - Policy and guidance
  - Standards and architectures
- Program Execution & Oversight for non-acquisition IT programs & procurements
- Policies
  - DoD 5200, 8500
  - AF 33-XXX



# ***Overarching S/W Policy – Must support all activities across AF***

## **SAF/AQ & SAF/US (Acquisition)**

- Policy & Guidance for Acquisition Programs

## **SAF/XC**

**(Warfighting Integration/CIO)**

- Implements CCA
- Interoperability &

**This is a “legacy” construct –  
“WE” no longer have “us” and “them”**

### ■ Policies

- DoD 5000
  - NSS AP 03-01
- AF 63-XXX

**Oversight for non-acquisition  
IT programs & procurements**

### ■ Policies

- DoD 5200, 8500
- AF 33-XXX



# ***Overarching S/W Policy – Must support all AF domains***

## **SAF/AQ & SAF/US Oversight**

- Policy & Guidance for Acquisition Programs
- Program Execution & Oversight for formal acquisition programs
- Space, non-space, AIS
- Policies
  - DoD 5000
  - NSS AP 03-01
  - AF 63-XXX

### **Warfighting**

## **SAF/XC Oversight**

- Implements CCA
- Interoperability & interconnectivity
- Policy and guidance
- Standards and architectures
- Program Execution & Oversight for non-acquisition IT programs & procurements
- Policies
  - DoD 5200, 8500
  - AF 33-XXX

### **Business**

### **Infrastructure**





# ***Overarching S/W Policy – Must support all AF domains and all AF systems***

## **SAF/AQ & SAF/US Oversight**

## **SAF/XC Oversight**

### **Warfighting**

Flt Ctrl Computers      Tactical Data Links  
Inertial Nav System      Jt Tact Radio Sys      Exp Combat Spt Sys (ECCS)  
Wpns Stores Mgt      SBIRS

### **Business**

AF Portal      Medical Logistics (MEDLOG)  
Virtual Persl Serv Center      Security Forces MIS

### **Infrastructure**

Global Transptn Network  
Air & Space Ops Center      Defense Message System  
GCSS-AF



## ***Disciplined LC Framework for AF S/W Policy – A SAF/AQR & SAF/XC Top Priority***

- **Purpose: establish framework and mechanism for the joint development & promulgation of appropriate AF S/W policies**
  - **Near & Mid Term**
    - **Develop software Life Cycle (LC) framework**
      - Define LC phases common to all S/W
      - Identify unique elements within different S/W domains
    - **Conduct S/W LC framework gap analysis**
    - **Develop S/W Policy Framework – Identify & prioritize areas in S/W LC needing AF S/W policies**
  - **Long Term – institutionalize process**
    - **Determine appropriate policy documents for AF guidance**
    - **Leverage existing venues (e.g. SSTC) for information exchange**
- **Optimize value and ease of use of AF S/W Policies**
  - **Encourage using cross-cutting disciplines in S/W LC**